

- a. *Buttressed tree trunks.* Tree species (e.g., *Taxodium distichum*) may develop enlarged trunks (Figure C1) in response to frequent inundation. This adaptation is a strong indicator of hydrophytic vegetation in non-tropical forested areas.
- b. *Pneumatophores.* These modified roots may serve as respiratory organs in species subjected to frequent inundation or soil saturation. Cypress knees (Figure C2) are a classic example, but other species (e.g., *Nyssa aquatica*, *Rhizophora mangle*) may also develop pneumatophores.



Figure C1. Buttressed tree trunk (bald cypress)



Figure C2. Pneumatophores (bald cypress)

- c. *Adventitious roots.* Sometimes referred to as "water roots," adventitious roots occur on plant stems in positions where roots normally are not found. Small fibrous roots protruding from the base of trees (e.g., *Salix nigra*) or roots on stems of herbaceous plants and tree seedlings in positions immediately above the soil surface (e.g., *Ludwigia* spp.) occur in response to inundation or soil saturation (Figure C3). These usually develop during periods of sufficiently prolonged soil saturation to destroy most of the root system. *CAUTION: Not all adventitious roots develop as a result of inundation or soil saturation. For example, aerial roots on woody vines are not normally produced as a response to inundation or soil saturation.*



Figure C3. Adventitious roots

- d. *Shallow root systems.* When soils are inundated or saturated for long periods during the growing season, anaerobic conditions develop in the zone of root growth. Most species with deep root systems cannot survive in such conditions. Most species capable of growth during periods when soils are oxygenated only near the surface have shallow root systems. In forested wetlands,